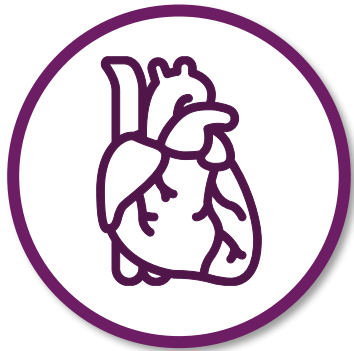




Heart Failure

Inadequate perfusion to meet the body's oxygenation demands

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LEARNING OBJECTIVES

1

Differentiate the pathophysiology and manifestations of left-sided versus right-sided heart failure.

2

Identify diagnostic tests used to evaluate heart failure and cardiac function.

3

Prioritize immediate nursing interventions for clients experiencing acute heart failure symptoms.

4

Analyze pharmacological therapies and surgical interventions used in managing heart failure.

5

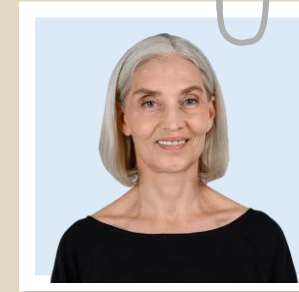
Formulate client teaching plans for lifestyle modifications and self-care in heart failure.

CASE STUDY

M.A.

Admission Notes

M.A. is a 67-year-old female who arrived to the emergency department due to worsening shortness of breath and dry cough. Client states head must be elevated using 2 pillows to sleep. Medical history is remarkable for hypertension which is managed with metoprolol. Client also had a respiratory tract infection 3 weeks ago.



Physical Assessment

- Oriented to person, place, and time
- Skin cool upon touch
- Crackles upon auscultation of bilateral lung fields
- S₃ and S₄ heart sounds heard
- Abdomen round and nondistended

Vital Signs

HR	132 bpm
RR	34 breaths/min
BP	141/98 mmHg
Temp	99.3°F (37.4°C)
SpO ₂	88% on RA



DISCUSSION QUESTIONS

What **findings** are consistent with the disease process of heart failure?

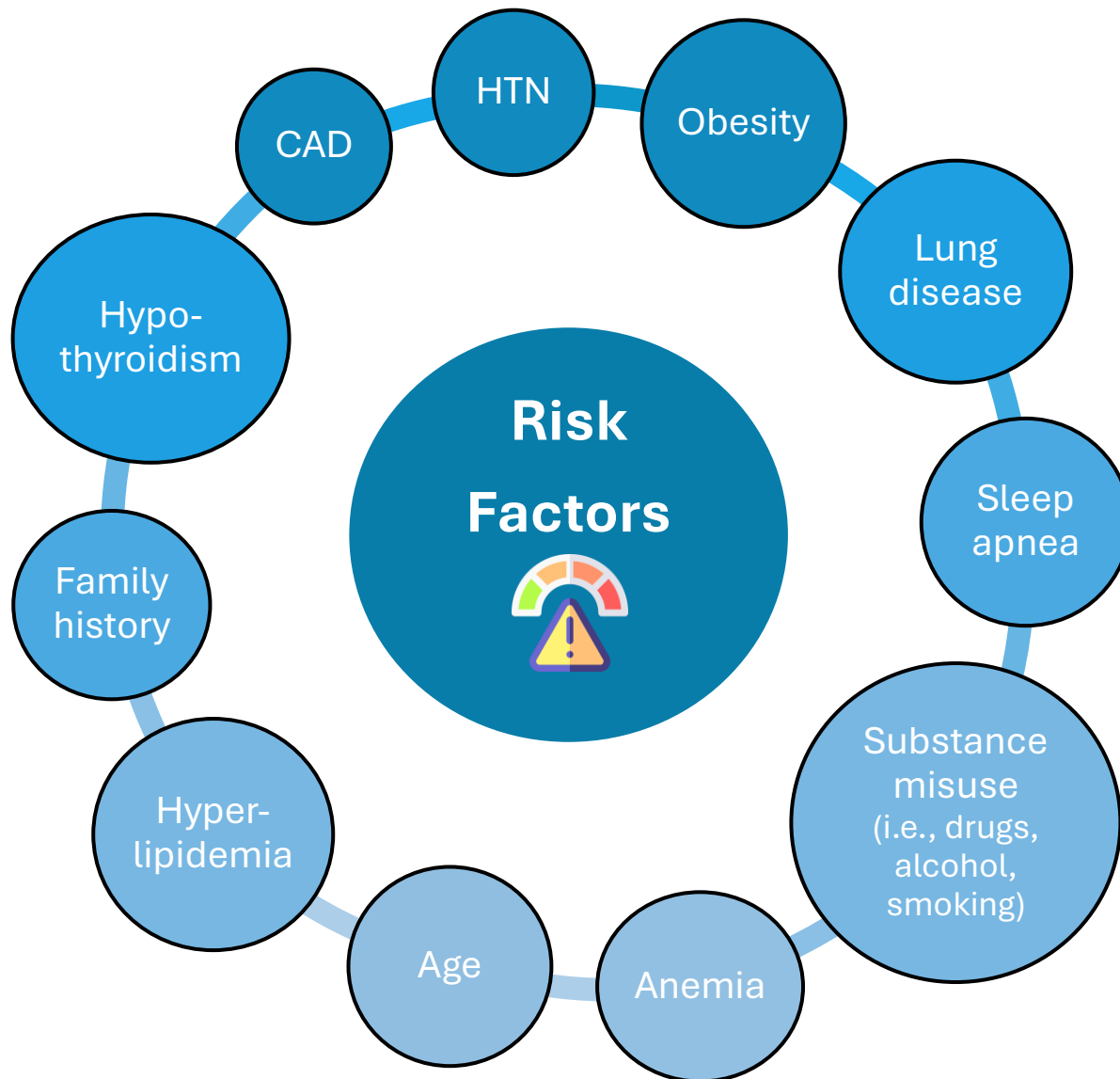
Is M.A experiencing **left-sided** or **right-sided** HF?

What actions should the nurse carry out **first**?

What are some **anticipated medication orders** for M.A.?

What **outcomes** are expected for M.A. after interventions are carried out?

ETIOLOGY



HF is preventable!

- Coronary artery disease (CAD) and hypertension (HTN) are the **most** common causes of HF
- By managing *modifiable* risk factors (i.e., HTN) clients can reduce the risk of developing HF

ETIOLOGY

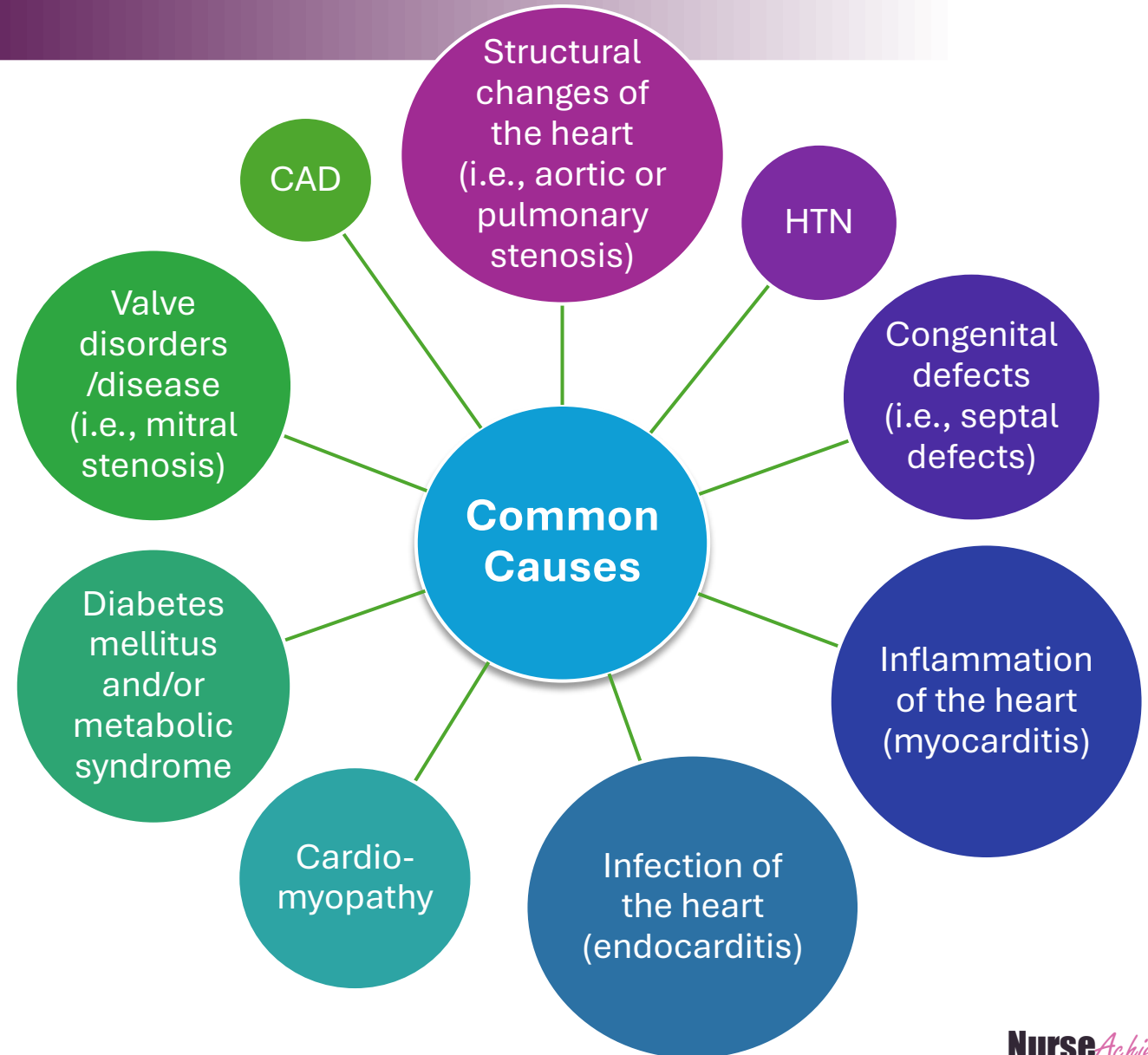


Any changes in the normal functionalities of the heart can impact cardiac output therefore, posing a risk for HF



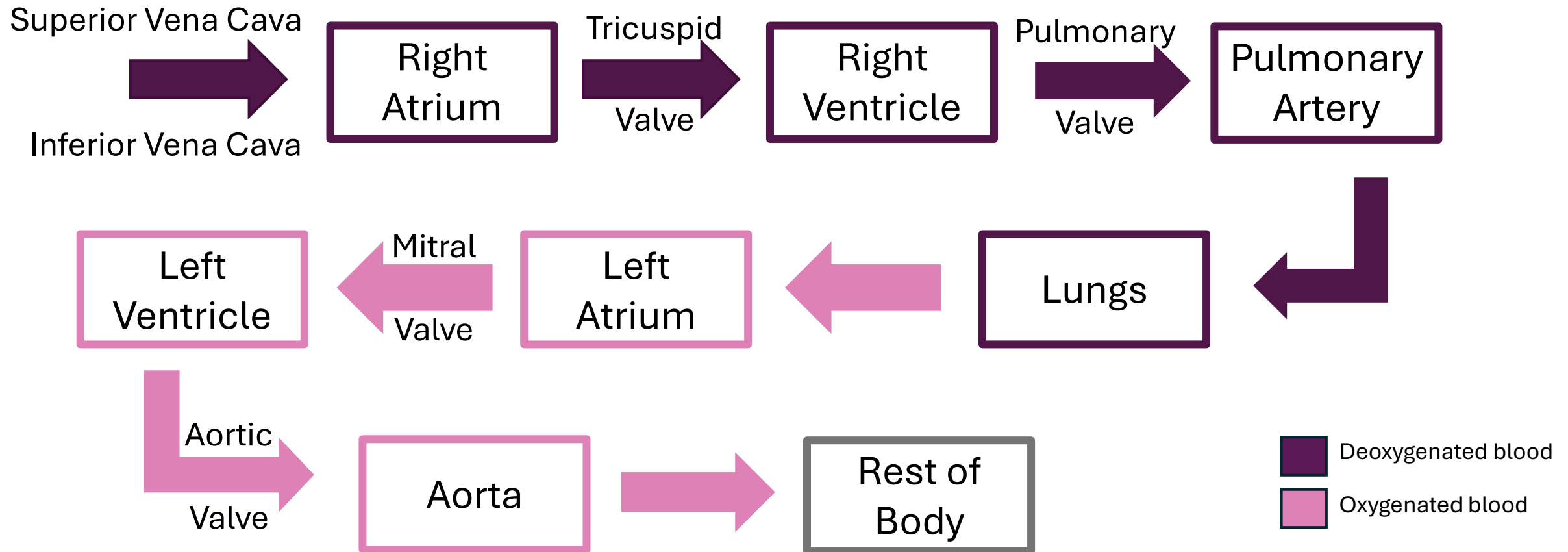
These **precipitating factors** can cause acute decompensation from chronic HF (CHF) to acute HF:

- Uncontrolled hypertension (i.e., non-compliance with BP medications)
- ↑ fluid/sodium intake
- Cardiac complications (i.e., ischemia/infarction, arrhythmia)
- Anemia, stress, infections, thyrotoxicosis
- Medications (NSAIDs and beta blockers)



PATHOPHYSIOLOGY

Circulation of Blood Through the Heart



PATHOPHYSIOLOGY

DEFINITIONS

Heart failure (HF):

inadequate perfusion to meet the body's oxygenation demands

Cardiac Output (CO):

volume of blood ejected from ventricles per minute

Stroke Volume(SV):

volume of blood ejected during systole

Afterload: the resistance the heart must overcome to eject blood during contraction

Cardiac injury (CAD, HTN, myocardial infarction, valvular heart disease)

Impaired ventricular systolic and diastolic functions

Reduced pumping efficacy of the heart

Decreased CO (SV x HR) leading to decreased tissue perfusion

Compensatory mechanisms stimulated:

- RAAS (renin- angiotensin- aldosterone system)
- SNS (sympathetic nervous system)

Water retention and constriction of blood vessels to maintain blood perfusion

↑Afterload, ↑ Blood Pressure, ↑ Heart Rate

Enlarging ventricular walls to generate a greater force of contraction (**remodeling**).

Hypertrophy, impaired contractility and ↓ CO.

PATHOPHYSIOLOGY

DEFINITIONS

Acute HF: sudden deterioration of signs and symptoms of HF

Chronic HF: a long-term condition of the heart that is characterized by the decreased pumping power of the heart muscle

Cor Pulmonale: enlargement of right side of heart due to pulmonary congestion

Hypertrophy, impaired contractility and ↓ CO

Left sided heart failure (LSHF)

Blood backups into lungs

Pulmonary congestion

Pulmonary edema

Right sided heart failure (RSHF)

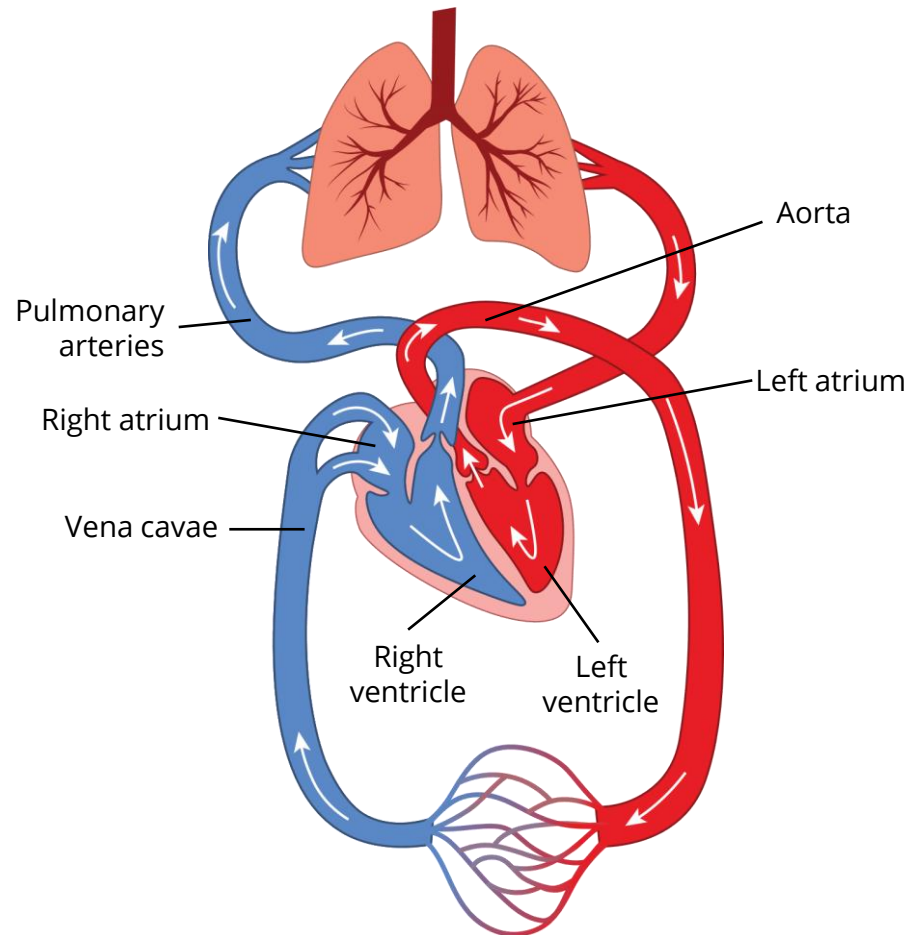
Blood backups into peripheral circulation

Weight gain

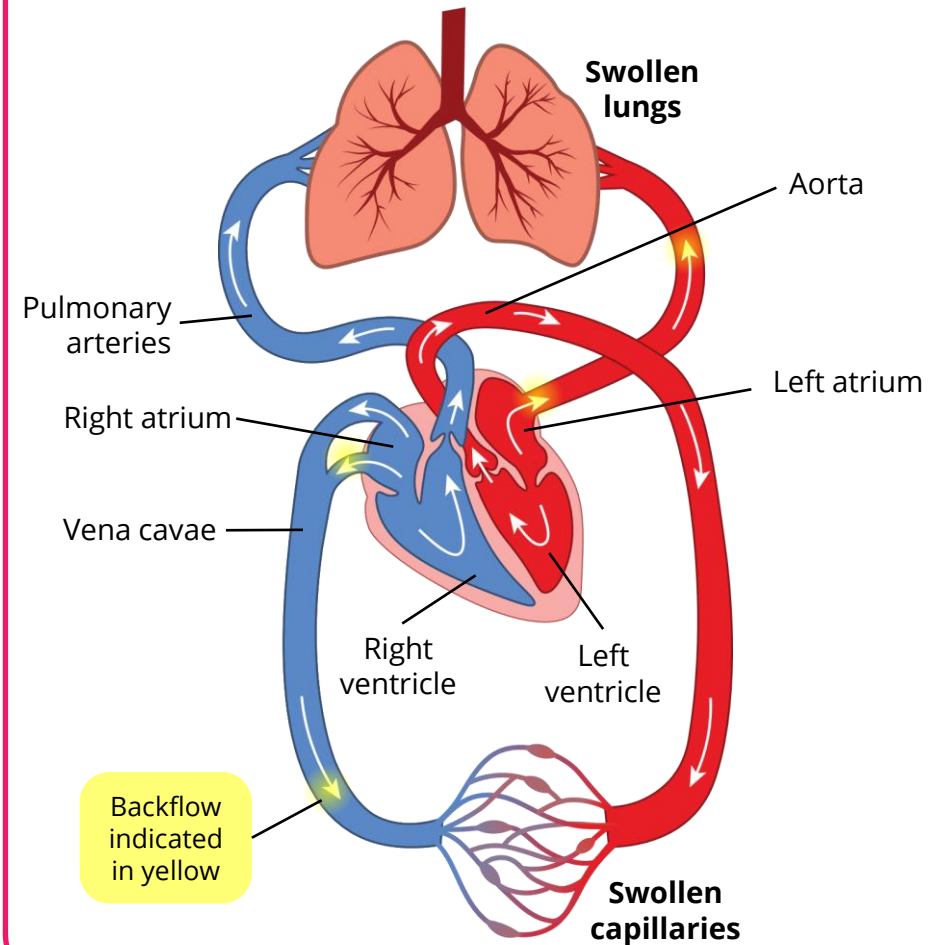
Peripheral edema

PATHOPHYSIOLOGY

NORMAL



HEART FAILURE

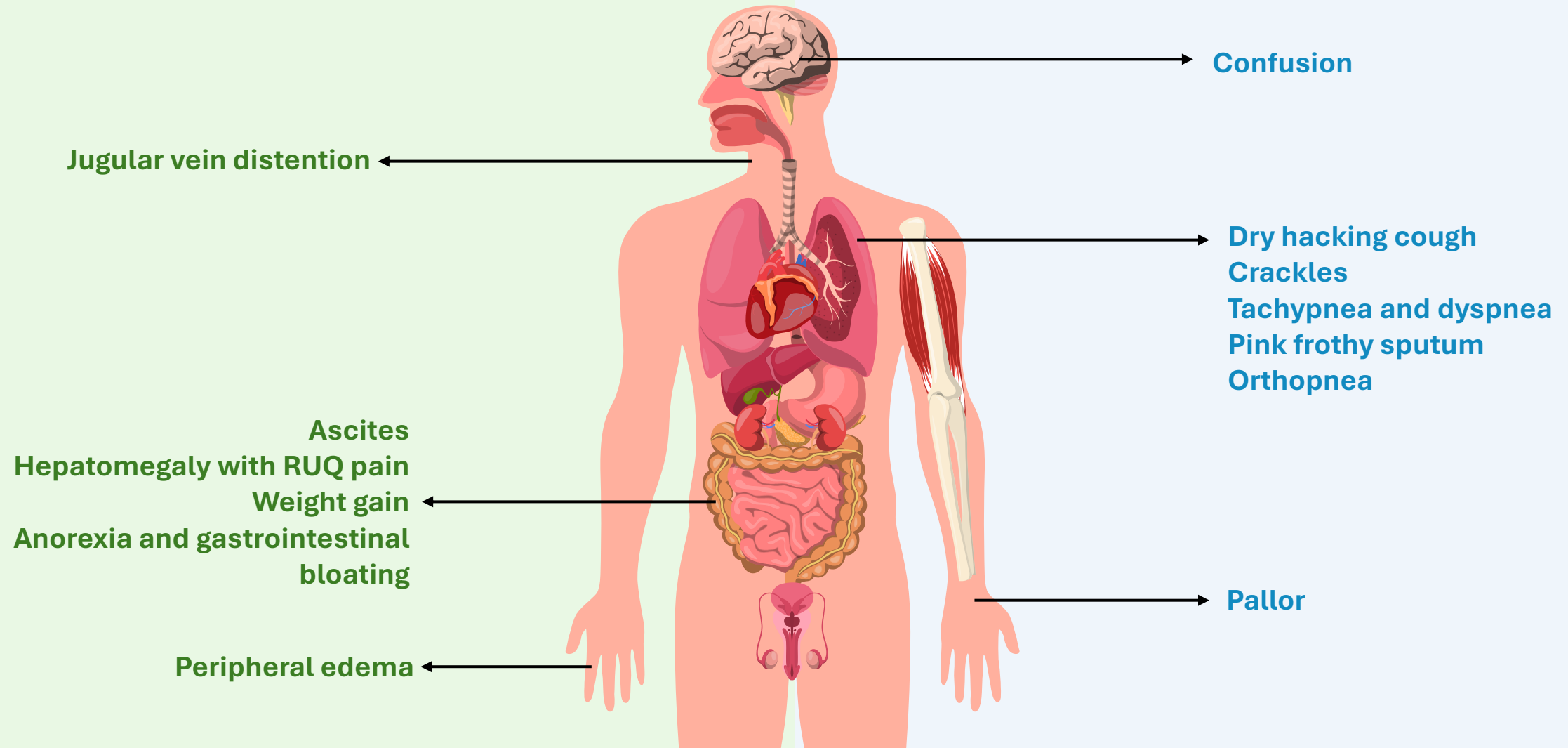


CLINICAL MANIFESTATIONS

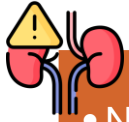
Both Left-Sided and Right-Sided HF: Anxiety, Depression, Fatigue, Tachycardia

Right Sided Heart Failure

Left Sided Heart Failure



COMPLICATIONS



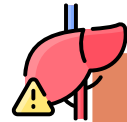
Cardiorenal

- Na⁺ and water retention is caused by activation of neuro-hormones (i.e., epinephrine, norepinephrine, oxytocin)
- Decreased renal functionalities (i.e., ↓ GFR, renal perfusion) + HF = ↑ risk of complications for HF and fatality



Anemia

- Vaso-contraction of kidneys and/or ↑ cytokine → ↓ erythropoietin → anemia → impacts the heart's ability to function and worsens symptoms of HF



Hepatomegaly

- ↑ Venous blood causes congestion in the liver
- Fibrosis and cirrhosis can develop as the hepatic cells die



Pleural Effusion

- Fluid leakage in the pleural space is caused by ↑ pressure in capillaries
- Can cause chest pain, cough and SOB



Dysrhythmias

- Clients with HF can have either ventricular or atrial dysrhythmias
- Causes include structural changes (i.e., fibrosis, stretching, enlargement of chambers)
- Atrial fibrillation, ventricular tachycardia/fibrillation are often seen in HF clients

DIAGNOSTICS

Most Common Diagnostic Assessments



Brain Natriuretic Peptide (BNP)

- Biomarker for diagnosis/exacerbation of HF detecting stretching of ventricles due to increased volume
- Helps to differentiate if dyspnea is related to HF or other cause

Lab/CBC Values

- Electrolyte imbalances
- Assess functionality of liver, thyroid and kidneys

Urinalysis

- Microalbuminuria is an **early warning sign** of reduced compliance of the heart, may show prior to BNP



Electrocardiogram (12-lead)

- Does not determine HF, however, can identify dysrhythmias, cardiac injury/ischemia/infarction and ventricular hypertrophy



Echocardiogram

- Non-invasive, **most sensitive test** when diagnosing HF
- Helpful in determining chamber dimensions/functionality, performance of the heart valves, wall thickness/movement, identifying blood clots and fluid, pressure in the lungs and heart and left ventricular ejection fraction (LVEF)

DIAGNOSTICS

Other Diagnostic Assessments



Chest x-ray

- Can aid in identifying LV failure



Angiography or cardiac catheterization

- Helpful in identifying cardiomyopathies
- For clients with sudden and unclear development of HF, endomyocardial biopsy may be completed during cardiac catheterization to assess the client's condition



Exercise stress test and 6 min walk test

- Used to assess cardiopulmonary function
- Often used in clients with chronic HF



Jugular Vein Distension (JVD)

- If the JV is distended when seated at 30–45-degree angle this can indicate fluid overload (related to RSHF)

NON-PHARMACOLOGICAL INTERVENTIONS



FLUIDS

- Milk products should be limited to 2 cups/day (part of low-sodium diet)
- Clients with mild to moderate HF may not require fluid restriction
- Fluid restriction is recommended for clients with **advanced HF**
- Clients with ↑ aldosterone secretion often feel thirsty therefore, these clients should be limited to 2 L/day



NUTRITION

- Low-sodium diet is recommended
- Sodium restriction is generally 2 g/day (amount may vary based on client's needs and other therapies initiated such as diuretics)
- Advise clients to add other spices or lemon juice for flavor
- Avoid foods with high sodium levels such as deli meats, cheese and processed food

NON-PHARMACOLOGICAL INTERVENTIONS



DAILY WEIGHTS

- Each day the client should be weighed at the same time (before breakfast), with the same scale and clothes to monitor for fluid retention
- **Report weight gain** to the HCP if the client gains **more than** 3 lb. (1.4 kg) in 48 hours or 3–5 lb. (2.3 kg) in 7 days



EXERCISE

- Clients should be encouraged to remain active by participating in activities that do not cause increased SOB or fatigue (i.e., walking)
- Can incorporate other activities slowly
- Plan rest periods after exercising
- Avoid exercising in extreme weather (i.e., heat waves, extreme cold)

PHARMACOLOGICAL INTERVENTIONS



ANTICOAGULANTS

 *heparin, rivaroxaban*

- **Purpose:** prevents development of thromboembolism.
- **Side/Adverse Effects:** bleeding, heparin-induced thrombocytopenia, hypersensitivity.
- **Drug Interactions:** aspirin or other medications that can increase risk of bleeding.



ANTIDYSRHYTHMIC DRUGS

 *sodium channel blockers, digoxin*

- **Purpose:** treats and/or prevents dysrhythmias.
- **Side/Adverse Effects:** various depending on medication (see Pharmacology deck).
- **Drug Interactions:** various depending on medication (see Pharmacology deck).



β -ADRENERGIC BLOCKERS

 *metoprolol, bisoprolol, carvedilol*

- **Purpose:** antagonizes SNS, inhibits activation of RAAS, and decreases afterload.
- **Side/Adverse Effects:** bradycardia, hypotension, fluid retention, fatigue.
- **Drug Interactions:** calcium channel blockers and insulin.

PHARMACOLOGICAL INTERVENTIONS



LOOP and THIAZIDE DIURETICS

 *furosemide, hydrochlorothiazide*

- **Purpose:** decreases fluid retention and blood pressure, and increases urine output.
- **Side/Adverse Effects:** hypotension, hypokalemia, hyponatremia.
- **Drug Interactions:** digoxin (if ↓ K^+), ototoxic drugs (loop diuretics only).



POTASSIUM-SPARING DIURETICS

 *spironolactone, eplerenone*

- **Purpose:** inhibits aldosterone to decrease Na^+ and fluid retention, decreases K^+ loss.
- **Side/Adverse Effects:** hyperkalemia, endocrine effects (hirsutism, irregular menstruation, gynecomastia).
- **Drug Interactions:** drugs that increase K^+ levels.



ACE INHIBITORS and ARBs

 *enalapril, benazepril, valsartan*

- **Purpose:** dilates arterioles/veins, decreases afterload, increases renal blood flow, and suppresses release of aldosterone.
- **Side/Adverse Effects:** hypotension, hyperkalemia, angioedema, chronic cough.
- **Drug Interactions:** diuretics, antihypertensives, drugs that increase K^+ levels, NSAIDs.

PHARMACOLOGICAL INTERVENTIONS



VASODILATORS

Rx *isosorbide dinitrate/hydralazine, nitrates*

- **Purpose:** dilates renal arteries, decreases preload, afterload and blood pressure.
- **Side/Adverse Effects:** orthostatic hypotension, reflex tachycardia.
- **Drug Interactions:** antihypertensives.



POSITIVE INOTROPES

Rx *dobutamine, dopamine*

- **Purpose:** increases contractility of heart and cardiac output.
- **Side/Adverse Effects:** tachycardia, dysrhythmias.
- **Drug Interactions:** MAO inhibitors, tricyclic antidepressants.



MORPHINE

Rx *morphine*

- **Purpose:** decreases anxiety and ease work of breathing.
- **Side/Adverse Effects:** respiratory depression, constipation, orthostatic hypotension.
- **Drug Interactions:** depressants, antihypertensives (see full list in Pharmacology deck).

PHARMACOLOGICAL INTERVENTIONS



DIGOXIN (a positive inotrope and cardiac glycoside)

Rx *digoxin*

- **Purpose:** increases contractility of heart and cardiac output, decreases heart rate, and reduces fluid retention.
- **Side/Adverse Effects:** cardiac dysrhythmias (due to hypokalemia or toxicity), nausea/vomiting, anorexia, fatigue, visual disturbances.
- **Drug Interactions:** diuretics, ACE inhibitors, ARBs, sympathomimetics, quinidine, verapamil.



Prior to administration:

- Assess heart rate and regularity (**DO NOT** administer if < 60 bpm)
- Monitor K⁺ levels (**DO NOT** administer if K⁺ levels are low)

SURGICAL INTERVENTIONS

HEART TRANSPLANT

- Ideal intervention for clients with end-stage HF and dilated or restrictive cardiomyopathy
- Co-morbidities may impact the client's candidacy for the transplant



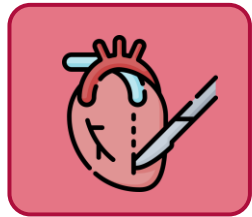
Nursing Interventions:

- Observe for post-operative bleeding
- Complete frequent respiratory and cardiovascular assessments
- **Report** signs and symptoms of transplant rejection to the HCP **immediately:**
 - SOB, feeling tired
 - Edema
 - ↓ HR (new onset)
 - ↓ BP
 - ↓ tolerance for activities
 - ↓ ejection fraction (late sign of rejection)

Heart Transplant Criteria

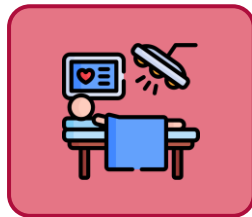
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|--|
| ✓ < 65 years of age |
| ✓ < 1 year of life expectancy |
| ✓ No psychosocial complications (client should be stable) |
| ✓ No active infection |
| ✓ Does not currently misuse alcohol or drug |
| ✓ Pulmonary vascular resistance should be normal or faintly elevated |

SURGICAL INTERVENTIONS



VENTRICULAR ASSIST DEVICES (VAD)

- Can be recommended for clients with end-stage HF and be used as a short-term intervention prior to a heart transplant
- Functionality of the implanted device (internal or external) is to pump blood into the heart and acts as the ventricle:
 - Blood is brought in by LA or LV → goes through device → blood pumped into the aorta
- Clients with a VAD require continuous care and support
- Providing family education is also critical in the client's plan of care
- **NOTE:** Some clients may not be ideal candidates for this intervention
 - i.e., clients with clotting complications, end-stage renal disease, frequent infections (especially clients who do not respond well to antibiotics) and chronic lung disease



OTHER SURGICAL INTERVENTIONS

- Endoventricular circular patch cardioplasty
 - Returns the LV to its previous shape = ↑ CO and EF
- Left ventricular reconstruction
 - Aims to increase the LV's functionality

HEALTH PROMOTION AND TEACHING



Encourage clients to get the **influenza vaccine** annually and other **respiratory virus vaccines** as needed (i.e., COVID-19).



Teach clients and family members about **signs and symptoms of HF** to watch out for including increase in weight, swelling (mostly seen in abdomen, feet and ankles), feeling tired, experiencing dyspnea/orthopnea and cough (typically occurs when the client is laying flat).



Educate clients about **risk factors** and implement a plan to reduce modifiable risk factors (i.e., taking BP medications to control HTN).



Advise clients to notify the HCP if:

- New symptoms arise
- Rapid weight gain/swelling
- Experiencing cold symptoms for more than 3 to 5 days
- Previous symptoms worsen
- Nocturia
- Feeling short of breath even at rest

CASE STUDY DISCUSSION

M.A

Admission Notes

M.A. is a 67-year-old female who arrived to the emergency department due to **worsening shortness of breath** and **dry cough**. Client states **head must be elevated using 2 pillows to sleep**. Medical history is remarkable for hypertension which is managed with metoprolol. Client also had a respiratory tract infection 3 weeks ago.



Physical Assessment

- Oriented to person, place, and time
- **Skin cool upon touch**
- **Crackles upon auscultation of bilateral lung fields**
- **S₃ and S₄ heart sounds heard**
- Abdomen round and nondistended

Vital Signs

HR	132 bpm
RR	34 breaths/min
BP	141/98 mmHg
Temp	99.3°F (37.4°C)
SpO₂	88% on room air



DISCUSSION QUESTIONS

What **findings** are consistent with the disease process of heart failure?

The client's **respiratory and cardiovascular symptoms** are consistent with the disease process of heart failure.

Symptoms of HF include:

- Fatigue
- Shortness of breath
- Orthopnea
- Pulmonary edema (crackles)
- Dry cough (blood-tinged sputum in advanced cases)
- S₃ and S₄ heart sounds
- Tachycardia
- Tachypnea

CASE STUDY DISCUSSION



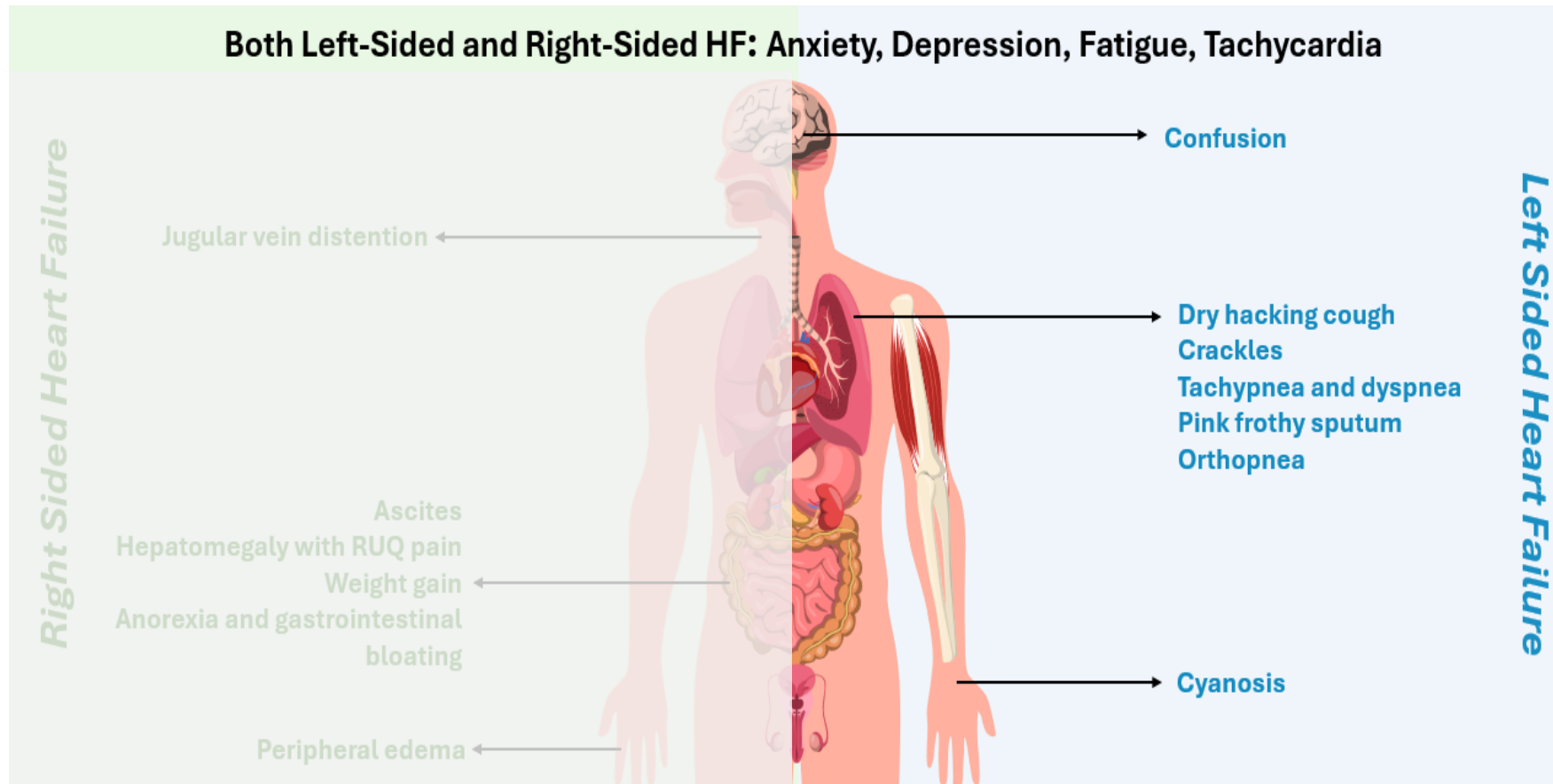
DISCUSSION QUESTIONS

Is M.A experiencing *left-sided* or *right-sided* HF?

The client is experiencing **left-sided HF** as evidenced by respiratory systems that have not progressed systemically.

Left-sided HF is the **most common type** of heart failure. The respiratory system is affected as a result of blood backing into the lungs, causing pulmonary congestion and edema.

Both Left-Sided and Right-Sided HF: Anxiety, Depression, Fatigue, Tachycardia



CASE STUDY DISCUSSION



DISCUSSION QUESTIONS

AIRWAY

Maintain High-Fowler's position

To ease work of breathing

Administer supplemental oxygen

To enhance perfusion and increase O₂ saturation

Contact Healthcare Provider

For medication and diagnostic orders

BREATHING

CIRCULATION

What actions should the nurse carry out *first*?

When prioritizing care for clients experiencing multiple concerns, use the **ABCs** to determine initial steps and interventions.

The client is experiencing manifestations **that impede airway and breathing** (pulmonary edema, shortness of breath, tachypnea, and dry cough). Initial nursing interventions to improve work of breathing include administration of supplemental oxygen and maintaining an upright position.

CASE STUDY DISCUSSION



ANTICOAGULANTS



ANTIDYSRHYTHMIC DRUGS



β-ADRENERGIC BLOCKERS



**LOOP and THIAZIDE
DIURETICS**



ACE INHIBITORS and ARBs



VASODILATORS



MORPHINE



CARDIAC GLYCOSIDES



POSITIVE INOTROPES



**POTASSIUM-SPARING
DIURETICS**



DISCUSSION QUESTIONS

What are some *anticipated medication orders* for M.A.?

Pharmacological interventions for management of heart failure include the medications listed on the left. Selection of drugs is **dependent on the client's symptoms** and severity of manifestations.

CASE STUDY DISCUSSION



DISCUSSION QUESTIONS

What **outcomes** are expected for M.A. after interventions are carried out?

When determining expected outcomes for the client, it is important to first analyze the client's initial presentation and abnormal findings. Expected outcomes are findings that shift from an abnormal state to an improved status (**towards normal findings**).

Expected outcomes for this client include clearance of airway, improved work of breathing, and normalized vital signs.

Abnormal Findings

- Shortness of breath
- Dry cough
- Skin cool upon touch
- Crackles upon auscultation
- S₃ and S₄ heart sounds
- Heart rate 132 bpm
- Respiratory rate 34 bpm
- Oxygen saturation 88% on RA

Trending towards
normal

Expected Outcomes

- Unlabored breathing
- Absence of cough
- Skin temp normal on touch
- Lung fields clear bilaterally
- Absence of heart murmurs
- Heart rate 60-100 bpm
- Respiratory rate 12-20 bpm
- Oxygen saturation > 95% on RA

SUMMARY



Pathophysiology:

Cardiac injury causes impaired ventricular systolic/diastolic functionality. This leads to reduced pumping efficacy of the heart muscle which causes ↓ CO

Decreased tissue perfusion causes the stimulation of RAAS and SNS

To maintain blood perfusion the body retains water and constricts blood vessels causing ↑ afterload, BP and HR

Remodeling of ventricular walls leads to hypertrophy, impaired contractility and ↓ CO which ultimately leads to LSHF and RSHF

Clinical Manifestations of LSHF: Confusion, dry, hacking cough, crackles, tachypnea and dyspnea, pink frothy sputum, cyanosis, orthopnea, fatigue, anxiety, ↑ HR

Clinical Manifestations of RSHF: peripheral edema, ascites, hepatomegaly (RUQ pain), JVD, weight gain, anorexia, GI bloating, fatigue, anxiety, ↑ HR



Diagnostics:

Most common include labs (BNP, CBC, urinalysis), 12-lead ECG and echocardiogram



Non-Pharmacologic Interventions:

Managing fluid and nutritional intake (sodium restriction)

Daily weight monitoring and exercise



Etiology:

The most common modifiable risk factors are CAD and HTN



Pharmacologic Interventions:

Anticoagulants, antidysrhythmic, β-adrenergic blockers, diuretics (loop, thiazide, K⁺ sparing), ACE inhibitors, ARBs, vasodilators, morphine, positive inotropes, cardiac glycosides



Complications:

Cardiorenal
Anemia
Hepatomegaly
Pleural effusion
Dysrhythmias

Surgical Interventions:

Heart transplant (ideal), ventricular assist devices, endoventricular circular path cardioplasty, left ventricular reconstruction



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